

RETURN TO WORK AFTER ISCHAEMIC STROKE IN YOUNG ADULTS: A SCOPING REVIEW

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SUMMARY

Objectives: The aim of the study was to synthesize the body of knowledge on the factors that are important to the process of returning to work after ischaemic stroke in young adults under 55 years of age.

Methods: Guidelines regarding the scoping review methodology developed by the Joanna Briggs Institute, and the PRISMA checklist for scoping reviews were used. A total of 2,249 studies were identified through a bibliographic search in six databases.

Results: A total of ten studies were finally selected to respond to the research questions. Eight studies were quantitative observational studies, and two studies had a case study design. The rate of returning to work varied between the studies. The frequency of returning to work in young stroke patients, independent of the time of assessment, ranged from 42.4% to 86%. Returning to work after ischaemic stroke in young adults is a complex process and multidimensional problem which is affected by clinical variables (level of neurological deficits, cognitive ability, independency in activities of daily living, fatigue and depression, cardiovascular factors), as well as the socioeconomic and occupational status.

Conclusion: There is insufficient evidence concerning interventions promoting return to work. Future studies should focus on examining effective interventions to help young stroke survivors return to work.

Key words: young adults, ischaemic stroke, return to work, scoping review

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INTRODUCTION

Recent data have shown a rising incidence of ischaemic stroke (IS) in younger adults (1, 2), along with a higher percentage of vascular risk factors at younger ages, resulting in a consistently increasing number of young people who live with physical and psychosocial sequelae of IS. Unlike stroke in older adults, the incidence of IS among young adults is rising globally (1). Recent global burden reports highlight that IS affects around 79,500 cases per year among adults under 50 years of age in the United States, representing approximately 10% of all IS cases (3). In the US, the incidence of stroke for adults aged 20–44 years was shown to increase from 17 per 100,000 US adults in 1993 to 28 per 100,000 US adults in 2015. In Europe, for adults younger than 55 years the incidence for IS increased from 10.7 per 100,000 adults in 1994–2002 to 18.1 per 100,000 adults in 2003–2011 (1). Data are scarce for stroke incidence in young adults in the Czech Republic. Stroke incidence data for the Czech Republic have been reported based on an administrative database called the National Registry of Hospitalized Patients (NRHOSP). The last reported overall incidence of hospitalised stroke using the NRHOSP was 211 cases per 100,000 population per year and the prevalence was estimated at 240,000 cases (4).

Younger age at IS onset has deep public health and economic implications (5). The expected proportion of young patients

aiming to return to work (RTW) is high (6, 7). Therefore, the importance of the ability to RTW after IS at this socioeconomically demanding phase of life (7) is growing (8). RTW or continuity of work life is a common goal in the rehabilitation process as well as an indicator of recovery (9) for young adults after IS, significantly contributing to a better quality of life of young stroke survivors (2, 10, 11). On the other hand, a lack of individually tailored rehabilitation programmes focusing on RTW of young adults after IS has been identified in qualitative studies investigating younger adults' experiences following a stroke (12, 13).

There are inconsistencies in the literature regarding the age cut-off to define “young adults”, mainly the upper age limit (14, 15). In stroke studies, the upper age limit ranged from 45 to 65 years of age. A considerable number of empirical studies and their syntheses (9, 16, 17) used a broader range for defining young adults to capture studies of working-aged adults. The reported RTW rate after IS in working age varied between studies (9, 16, 18) due to methodological variations between studies (18). In addition, there is currently incomplete or insufficient evidence regarding factors affecting the process of RTW after IS in young adults. Previous systematic reviews focused on the concept of RTW (8), methodology used in RTW studies (19), factors, facilitators, and barriers to RTW (9, 16, 20–22), or outcomes of RTW (18), and effectiveness of intervention promoting the process of RTW after stroke in general (18, 23). The three available syntheses

of qualitative and quantitative research (9, 16, 20) describing the rates and predictors of RTW after young stroke were heterogeneous regarding the type of stroke and included working-aged adults (< 65 years of age). These reviews did not specifically address the issue of RTW after IS. Only one review was limited to IS in working-aged adults (8). However, this review used a broader definition of young stroke (< 65 years of age). In line with a recent epidemiological narrative review by Yahya et al. (1), we included studies focusing on adult population aged 55 or younger in this review. The reasons for choosing the upper age limit of 55 years rather than the usual 65-year cut-off were as follows: this study group reflects the working population reasonably well, comorbidities increase with age and RTW is more likely in younger (13).

In this review, we aimed to gain an understanding of the factors that are important to the process of RTW after IS under 55 years of age.

MATERIALS AND METHODS

The scoping review was carried out as a part of the research project Factors Affecting the Quality of Life After Ischaemic Stroke in Young Adults (FRAILTY) registered on ClinicalTrials.gov (NCT04839887, of April 9, 2021, REDACTED). Guidelines for scoping reviews developed by the Joanna Briggs Institute (24) and the PRISMA checklist for scoping reviews (25) were used to identify key concepts and gaps in the contemporary evidence regarding RTW of young stroke survivors, thus providing implications for future research in this area. The following methodological steps for scoping reviews were applied: identifying a review question, identifying inclusion criteria, identifying search strategy and selecting studies, data extraction, and data analysis and presentation.

Review Questions

The specific research questions that guided the scoping review were:

- What is the rate of return to work for young stroke survivors?
- What are stroke survivors' experiences on returning to work?
- What are the factors of return to work in young stroke survivors?
- What kinds of interventions were useful in supporting young stroke survivors to return to work?

Search Strategy

A bibliographic search of the literature was conducted in November 2022. In order to make the selection, study inclusion/exclusion criteria were specified, relevant search terms were determined, and search strategies and databases were selected. A reference librarian was consulted for existing literature searches. The electronic literature search covered a period from January 2000 to October 2022 using MEDLINE (via OvidSP), CINAHL Plus with Full Text (via EBSCOhost), APA PsycINFO (via EBSCOhost), SocINDEX with Full Text (via EBSCOhost), Web of Science Core Collection (via Clarivate Analytics), and ProQuest

Central (via ProQuest). The search terms were modified for use in each database and included terms or their synonyms related to ischaemic stroke/return to work/young adult (Supplementary Materials). The search terms were applied to article titles, abstracts, and keywords and additionally matched to medical subject headings (MeSH) terms. The Boolean operators "AND" and "OR" were used to combine the terms from both groups and within the groups, respectively. The search was restricted to English language and the specified time frame.

Selection Criteria

The data were systematically retrieved by three independent researchers (D.B., R.Z., E.G.), following the PRISMA flow diagram (Fig. 1). The free web and mobile application Rayyan* was used to retrieve studies and remove duplicates (the latter was carefully done by a human) (26). The PCC (population, concept, and context) mnemonic was used to identify meaningful criteria for this scoping review.

The inclusion criteria were as follows:

- *Participants*: Studies involving participants with a clinical diagnosis of IS were included. However, relevant heterogeneous studies comprising a sample of individuals with IS as well as other stroke types were considered if a substantial part of the sample (more than 60%) consisted of young adults with IS;
- *Concepts*: RTW was the central concept investigated in this scoping review. RTW was defined as employment status, which was either self-reported or assessed by using outcome scales or measurement tools that included items related to employment after stroke (7);
- *Context*: The age range from 18 to 55 years was applied for "young stroke" patients. Recent studies on stroke define "young adults" as being between the ages of 18 and 55 (1, 27). Therefore, only studies with patients up to 55 years with a first-ever IS were included in this review.

Excluded were published protocols of studies, discussion papers, reviews, editorials, conference abstracts, books, reports, dissertations, expert opinions, and studies focusing on other than patients' perspectives. Grey literature was also excluded, and so were studies with individuals older than 55 years at the time of their IS.

Data Extraction and Analysis

Eligibility assessment and data extraction were conducted by two researchers (D.B., E.G.), and the full texts of selected sources were analysed for final inclusion in the review. A third independent researcher (R.Z.) evaluated the studies for which an agreement on inclusion could not be reached. Any disagreements were resolved based on the consensus of all reviewers. After the search was done, quantitative, qualitative, and mixed-method studies published in English were included in the analysis. Descriptive data extracted from each study included author/year/country, objective, study design, number of participants, age of participants at the time of the study, data collection details (limited to RTW), and time of assessment after IS. These data were abstracted into a pre-prepared

*<http://rayyan.qcri.org>

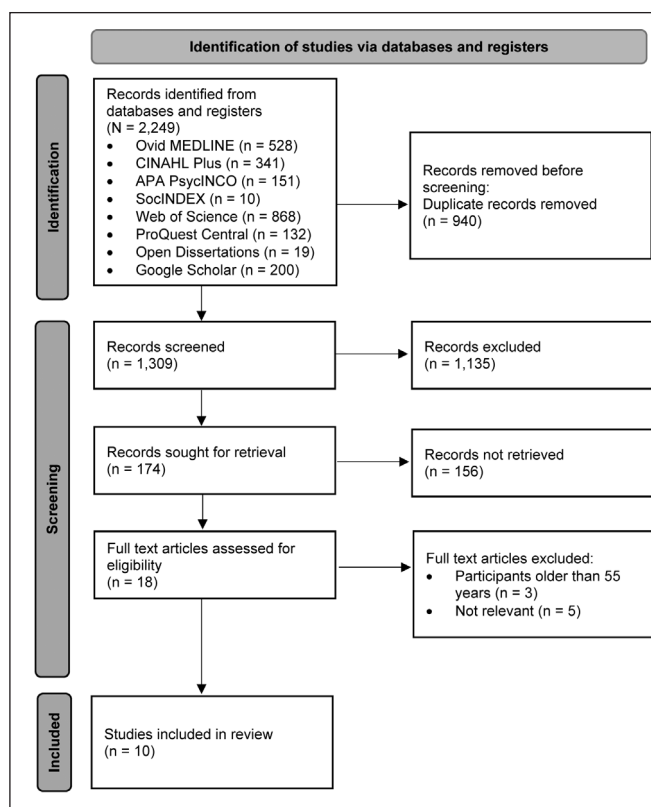


Fig. 1. Flow diagram of the study selection process.

table in MS Word and used primarily to document the focus of the scoping review conducted. Furthermore, data synthesis was performed based on the review questions that included the following data: rate of RTW, factors influencing RTW (including measures and statistical analyses used), and interventions useful in supporting young stroke survivors to RTW. These data were analysed and then classified based on their relevance to each theme. The data relating to rate of RTW were then added to a table incorporating data in terms of their descriptive nature. Themes related to factors of RTW were created and sorted based on their relevance into categories related to factors regarding physical impairment and associated diseases; psychological factors; and demographic and job-related factors. Due to a small number of studies focusing on supporting interventions, these were only descriptively reported. All independent researchers (D.B., R.Z., E.G.) were involved throughout this process.

RESULTS

Search Results

A total of 2,249 studies were identified, of which 940 were duplicates. Subsequently, 1,309 articles were screened by titles and abstracts. Records from Open Dissertations and Google Scholar were also screened at the first stage and removed for not meeting the standards of a scoping review ($n=219$). Given the RTW in young age study design, 916 records were further removed in the first phase of screening (out of scope, wrong population). Subsequently, 174 studies were assessed for inclusion criteria

with respect to the stated criteria of the study (participants and context). Only studies with the concept of RTW in young adult patients aged 18–55 years with a diagnosis of IS were included at the title and abstract level. Studies where the type of stroke was not strictly determined at the abstract level were also included. Eighteen full text articles were assessed for eligibility. Assessment of full texts revealed that three studies comprised patients older than 55 years and five did not provide relevant answers to the pre-defined review questions. Finally, ten studies were included in the scoping review that met the requirements based on the PCC mnemonic (Fig. 1). Whereas RTW rates were available in eight studies, the experiences of individuals were described in two (28, 29). Results on factors influencing RTW were mentioned in nine studies; one study did not report this information and focused more on supportive interventions (29). These interventions were featured in only two studies (28, 29).

Characteristics of Included Studies

The characteristics of the studies are presented in Table 1. Most of the retrieved studies have been carried out in the last 10 years, with only two being slightly older (11, 26). Four were even published in 2021 (29–32). The studies come from different countries but three of them are Swedish (11, 31, 33). Different designs were used, including a cohort study (5, 11, 31–33), observational study (30), population-based long-term follow-up study (34), and case study (28, 29). The number of participants ranged from one for case studies to 2,087 patients with IS (33). In all studies, the age of young adults with IS was determined by a pre-defined criterion, including patients up to 55 years. The lowest age cut-off was 15 years in one of the studies (34) but often it was set at 18 years (5, 11, 30–32). Most frequently, information on RTW was obtained as part of follow-up studies. However, multiple types of measures and analyses were often used to identify factors associated with RTW (Tables 2–4). The periods of follow-up ranged from 12 months (33, 29) to 18 years in the study by Aarnio et al. (2), all the other retrieved studies can be included in that interval.

Synthesis of Findings

Rate of RTW and related experiences among young IS survivors

The frequency of RTW in young stroke patients, independent of the time of assessment, ranged from 42.4% (34) to 86% (11). In contrast, the prevalence of unemployment or non-return to work (NRTW) ranged from 21% after 7 years (31) to 46.9% after 5 years of assessment. Problematic RTW was identified in cases where the NIH Stroke Scale score was > 15 at the time of discharge. Only 8.7% of these IS patients were able to RTW after one year; one of them stopped working after two years and another returned to work after five years (2). In one of the identified case studies, RTW was very difficult despite reduced hours and the patient decided to leave the job after 12 months (28). Occupation status was also changed in 7% of IS patients in another study (30). Two of the studies reported part-time RTW, ranging from 33.9% (34) to 46% (31) at the time of follow-up (seven to almost 12 years). In another study, the highest risk of disability payment was observed in patients between 35 and 44 years of age and a nine-fold higher risk of unemployment was observed in young adult stroke patients compared to the general

Table 1. Characteristics of included studies

Author (year), country	Aim	Study design	Participants	Age	Data collection of RTW/NRTW	Measure time (time of assessment after stroke)	Main findings
Aarnio et al. (2018) Finland (2)	To investigate the proportion of non-return to work (NRTW) young patients at 1 year after ischaemic stroke (IS) and during follow-up (FUP), and clinical factors associated with NRTW	A registry-based FUP study (recruited from the Helsinki Young Stroke Registry)	769 patients with first-ever IS who worked during the last year before stroke	Mean: 44 years (range 37–47 years)	Work history from the Finnish Centre for Pensions	Mean FUP: 10.5 years (range 0.1–18.0 years)	289 (37.6%) IS patients were not working at 1 year, 323 (42.0%) at 2 years, and 361 (46.9%) at 5 years after IS. Only 8.7% of 23 patients with National Institutes of Health Stroke Scale (NIHSS) scores >15 points at discharge, of whom 11 died before discharge and 2 more died within 3 months, went back to work at some point after IS. One patient went back to work at 1 year after IS, but stopped working at 2 years, and another patient went back to work at 5 years after IS.
Glader et al. (2017) Sweden (33)	To investigate the relationship between socioeconomic status and return to work (RTW) in younger stroke patients at working age	A registry-based cohort study (recruited from the Swedish stroke registry Riksstroke and Longitudinal Integration Database for Health Insurance and Labour Market Studies in Sweden (LISA))	2,087 patients with IS (82%) out of a total of 2,539 patients with different types of stroke	Range: 25–55 years	Before stroke: LISA After stroke: Riksstroke FUP question (5 options to answer)	1-year FUP	1,607 (74.0%) IS patients out of a total of 1,880 stroke patients RTW 12 months after the stroke. Of the entire sample, 75.4% were men and 71.8% were women.
Gustafsson and Turpin (2012) Australia (28)	To explore the RTW experience from the perspective of one person with mild stroke	A narrative analysis of e-mail conversations over a period of three years	One female participant (initial symptoms: right facial weakness, incoherent speech followed by speech loss and right-sided weakness progressing to paralysis)	32 years old	Extracting correspondence that related to RTW, job training or job experience – a stroke survivor identified the academic on the internet and made email contact about his situation	3 years (from 3 to 6 years after stroke)	RTW with reduced hours was identified as difficult by the IS stroke survivor due to unknown, hidden impairments. Between 10 and 12 months, which were very difficult, the stroke survivor decided to leave the work-place and change career.
Chan et al. (2021) Malaysia (32)	To describe the demography and evaluate the long-term functional outcomes of young stroke survivors in Malaysia	A prospective cohort study (recruited from the University of Malaya Medical Centre Young Stroke Registry)	75 first-ever Malaysian young stroke patients, of whom 52 (69.3%) had IS	Mean: 43 years (range 25–51 years)	An interview in person or by phone for patients who were unable to come (19 assessments were conducted via phone interviews)	Mean FUP: 14.8 months (range 11–21 months)	7 patients were housewives or unemployed during the onset of stroke and remained status quo post stroke. From the rest of the assessed population (n = 68), 39 (57.4%) patients RTW by 1 year after stroke. A larger proportion of IS survivors RTW: 47 (64%) as compared to haemorrhagic stroke survivors: 21 (43%).

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Table 1. Characteristics of included studies (Continued from the previous page)

Author (year), country	Aim	Study design	Participants	Age	Data collection of RTW/NRTW	Measure time (time of assessment after stroke)	Main findings
Lindström et al. (2009) Sweden (13)	To examine factors that are associated with RTW in young stroke patients	A prospective cohort study (recruited from the Swedish hospital-based national quality registry for stroke care, Risk-Stroke)	Young stroke patients with a first-ever IS who worked before: 660 (77.2%) out of a total of 855 patients	Range: 18–55 years	Self-reported measure (questionnaire with 97 items)	22 months (range 8–30 months)	For IS patients RTW: 440 (66.8%); NRTW: 219 (33.2%). The same workplace: 77% of patients. RTW within 12 months after stroke: 86% (half of them RTW within 3 months and the other half between 3 and 12 months).
Maaijwee et al. (2014) Netherlands (7)	To examine the prevalence and risk of unemployment in young stroke patients, compared with a nationwide control group	A prospective cohort study (recruited from FUP of transient ischaemic attack and stroke patients and Unelucidated Risk Factor Evaluation – FUTURE study)	Young stroke patients with a first-ever IS who worked before: 425 (61.2%) out of a total of 694 patients	Mean: 39.1 years (SD ± 8.1; range 18–50 years)	Data of disability payments provided by the national registry – Central Bureau of Statistics (CBS)	Mean FUP: 9.1 years (SD ± 7.9) Median: 7.2 years (interquartile range 2.1–14.9)	Prevalence of unemployment for IS patients: 202 (29.1%) range 25.9%–43.9%. Patients between 35 and 44 years had the highest risk of disability payment compared with a nationwide control group. Almost 9 times higher risk of unemployment for young stroke patients compared with the general population.
Samuelsson et al. (2021) Sweden (31)	To examine the relationship between late cognitive ability and employment in young stroke patients with good physical recovery	A cross-sectional cohort study (recruited from Sahlgrenska Academy Study on Ischaemic Stroke –SAHLISIS)	142 young stroke patients with a first-ever IS and with good physical recovery	Mean: 43 years (SD ± 9.3; range 18–55 years)	Data related to RTW: no work versus full- or part-time work; type of work at index stroke was classified into four ordinal skill levels according to the Swedish Standard Classification of Occupations	7-year FUP	IS patients at the time of the index stroke – work full-time: 104 (73%), work part-time: 13 (9%). IS patients at FUP: 112 (79%) were in full- or part-time work and 30 (21%) had full disability pension or sick leave. Of those in work, 60 (54%) were working full-time and 52 (46%) part-time.
Shihmanter et al. (2021) Israel (30)	To evaluate and FUP adults younger than 55 years of age, following hospital discharge for acute IS. If younger patients differ in their risk factors, IS characteristics, and outcomes, also to compare IS patients from a younger subgroup (aged 18–45 years) with those from an older one (aged 46–55 years)	A prospective observational study	178 individuals with discharge diagnosis of IS between 2001–2010 divided into older (46–55 years, n = 118) and younger (18–45 years, n = 60) age groups; disability FUP obtained from 138 patients	Mean: 46.5 years (SD ± 7.6; range 18–55 years) Median: 48 years	London Handicap Scale (LHS): providing a descriptive profile of disadvantages experienced in the domains of mobility, physical independence, orientation, social functioning, economic self-sufficiency, and occupational status (OS)	Mean FUP: 5.1 years (SD ± 2.5)	IS patients RTW without changing OS: 82 (60%), RTW with changing OS: 10 (7%), not able to work: 46 (33%).

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Table 1. Characteristics of included studies (Continued from the previous page)

Tani et al. (2021) Japan (29)	To report the RTW and after-RTW support for post-stroke patients from a combined ergonomic and rehabilitation perspective	A case study	One male participant (diagnosed with left-sided spastic hemiplegia)	45 years old	Before RTW: preparation of the workplace equipment and determination of information exchange 16 months after IS: brief evaluation of residual motor function, on-site task analysis using the work sampling and time-and-motion methods + interviews	12 months (from 4 to 16 months after stroke)	The patient was eager to RTW, and his manager in the pharmacy requested RTW support from Fukuoka Occupational Health Support Centre (FOHSC).
Waje-Andreassen et al. (2013) Norway (34)	To investigate memory, anxiety, depression, and sleep in relation to excellent functional outcome and full-time work versus part-time or no work among patients and controls at the second FUP	A population based on long-term FUP	144 IS patients retrospectively selected and 167 age- and sex-matched controls	Mean: 41.1 years (SD \pm 7.5; range 15–49 years)	Self-assessment questionnaire	Mean FUP: 11.8 years	Working full-time: 61 (42.4%) IS patients, 92 (55.1%) controls. Patients working full-time: 49 (57.6%) out of 85 patients without memory problems, 12 (20.3%) out of 59 patients with memory problems. Reduced working time for IS patients: 20 (33.9%) patients without memory problems, 20 (23.5%) patients with memory problems.

population (5). One study also noted a lower percentage of RTW in women than in men (33). As for the experiences, primarily identified in the case studies, RTW was described as very difficult, with anxiety, exhaustion and lack of support being the main issues described (28). In another study, however, the patient was eager to RTW and supported by his manager (29). One study also included a sample of haemorrhagic stroke patients and identified a higher percentage of RTW among IS patients (32). The overall relative prevalence of return to work was 74.4%, and the overall prevalence was 66.9% (Fig. 2).

A statistically significant difference was found between frequencies of patients RTW and NRTW ($p=0.0099$). The chi-square test was used to investigate the RTW/NRTW groups' differences. The estimated inter-study variability was 58.55, with confidence intervals ranging from 25.59 to 242.52. This means that considerable heterogeneity between the studies in the analysis resulted from variability in the number of participants included in selected studies.

Factors of RTW in young IS survivors

Factors influencing RTW in young adult patients up to and including 55 years of age were thematically divided into three main groups, in which individual categories were created (Tables 1–3). Neurological, cardiovascular, and physical impairment-related factors represent a wide range of barriers to RTW (Table 2). It was found that in terms of neurological factors, NRTW is mainly due to the severity of stroke (5), aphasia, limb paresis, and visual field deficit (2). Cognitive function is also a major factor for full-time workers (31, 34). In the category of NRTW cardiovascular factors, type 1 diabetes, major anterior stroke, and small vessel occlusion (2) as well as large artery disease, hypertension, recurrent stroke, and carotid artery disease (30) have been identified. Factors related to physical disability are important for RTW in terms of functional outcomes and physical ability (32, 33), even in the context of full-time employment (31, 34). The second main group covers psychosocial factors influencing RTW. Among young stroke patients, depression and fatigue (28, 31), positive attitudes towards RTW, socioeconomic status and social support (11), and also social aspects such as being exhausted (28) or the perception of being a burden to others (11) have been identified as significant. Mood and pain have also been shown to be important (33). The third main group comprises demographic and job-related factors. Within job-related characteristics, occupational status (2) and patient income (33) were identified as factors for RTW/NRTW. Finally, in the category of demographic variables and other aspects, gender was identified as a factor, with men being more likely to return to full-time employment (31, 34). This, however, is contradicted by a study conducted one year after IS (2). Furthermore, NRTW has been associated with the level of education (32) as well as age (31, 33). Finally, according to Glader et al. (33), the country of birth and the time of follow-up also have an effect (5).

Interventions supporting young IS survivors to RTW

Interventions to support young adult IS patients, mentioned in only two case studies, include ergonomic and rehabilitation approaches after RTW which may contribute to work efficiency and potential future job retention. Importantly, it has been found that the use of support tools, especially for adaptation, can reduce errors and duration of the task and task analysis (29). In another

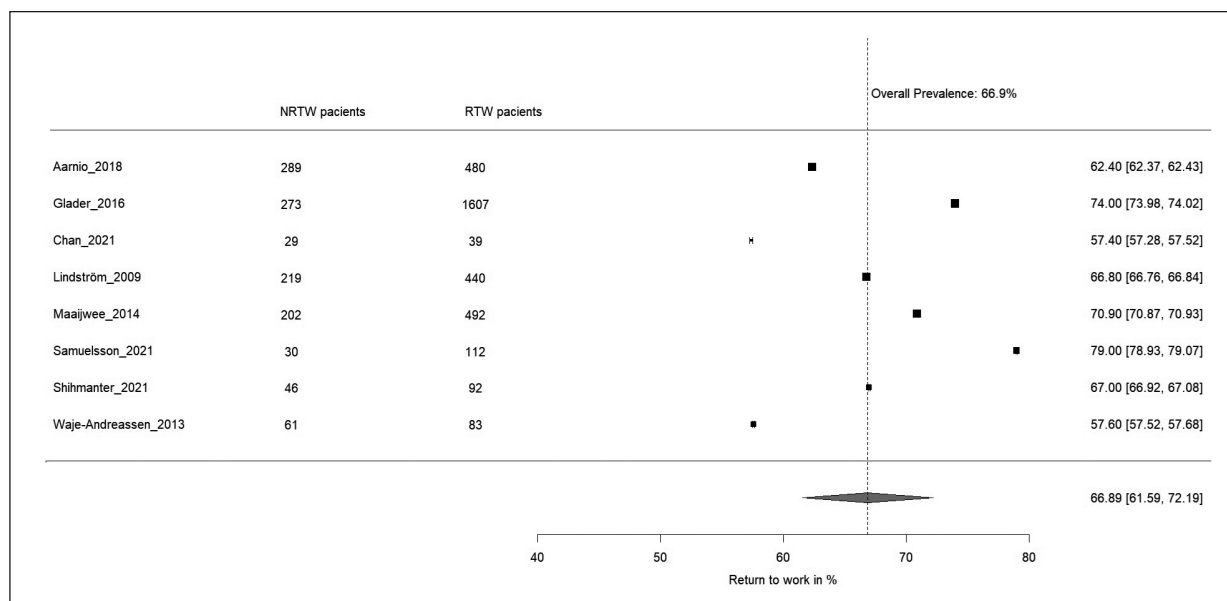


Fig. 2. A forest plot of RTW prevalence in cohort studies

case study, a need for a mentor or support person to help with RTW was expressed. In addition, there was a need for a supportive workplace and supervisor, particularly in terms of the structure and strategies necessary for adaptation. Within cognitive challenges, the primary internal strategies were information processing and the time it takes (28).

DISCUSSION

An alarming increase in traditional risk factors and substance abuse among young people contributes to the rising incidence of IS in young adults. This may not only result in disability and dependency, an increased risk of recurrent stroke and even high mortality, but also have serious implications associated with challenging age-related life tasks and loss of productive years of life (3, 18, 27). As previously reported, young adults are inadequately supported in their recovery by a stroke care system, as the care they receive is incongruent with their age-related needs (27). RTW as a significant sign of recovery is not adequately understood by healthcare personnel (15).

This scoping review focused on understanding the factors that are important for the RTW process after IS under 55 years of age. This is the first scoping review involving young adults up to 55 years of age. Although RTW is an important issue, the small number of identified studies of different design, sample size, and time frame shows that RTW is still a neglected area of IS research. Of the ten included studies, eight quantitative studies (2, 5, 11, 30–34) reported the rate and factors of RTW. Two remaining qualitative studies focused on RTW experience from a patient's perspective (28) and RTW support for patients from an ergonomic and rehabilitation point of view (29).

Not all young stroke patients are able to RTW. The rate of RTW in included studies varied, ranging from less than half (34) to 86% (11) of young patients after IS. A systematic review of 78 studies of IS patients of working age (younger than 65 years) reported a mean RTW rate of 44% (14). In another systematic

review, the median rate of RTW was 41% between 0 and 6 months, 5% at 1 year, 56% at 1.5 years, and 66% between 2 and 4 years after stroke. In general, the rate of RTW increases over time (7). However, five years after IS, almost half of young patients were not able to RTW and seven years after IS, 21% of the patients were still unemployed (31). Another included study found that the risk of being unemployed increased with the severity of stroke (5). As previously stated, an overall rate of RTW after IS cannot be reliably estimated (14) due to heterogeneity of studies and different cultural aspects, sick-leave systems, and social context in different countries (35).

RTW may be seen as proof of being rehabilitated and having overcome the disease; it can guarantee a high level of self-esteem and life satisfaction (18), independence and freedom (35), and affect physical fitness, emotions and cognitive functions (36). By contrast, NRTW can contribute to social isolation, anxiety, and depression (37). Although not reported at all, IS in young adults and their RTW or NRTW can have a significant impact on their family life. A review focusing on the experiences and rehabilitation needs of stroke survivors in relation to RTW (38) found that most stroke survivors consider recovery after IS longer than just the rehabilitation period. According to a qualitative meta-synthesis (37), there are four key concepts important for RTW after an acquired brain injury: empowerment, self-awareness, motivation, and facilitation. Knowing the aspects that infuse young adults' motivation is the key to successful RTW.

Our scoping review includes only two papers focusing on experience. In one study (28), a 32-year-old female participant had difficulties with the initial RTW and felt exhausted. She experienced fatigue and required longer time to complete tasks. For these reasons, she felt unfairly judged and unsupported (28). In the second study (29), a successful RTW case was in a context where occupation and job requirements matched with the person's work motivation and the employer's effort.

As our review revealed, current research has paid less attention to the experiences of young stroke survivors in RTW. Therefore, it is impossible to give a clear picture of such experiences.

Table 2. Neurological and cardiovascular factors, factors related to physical impairment associated with return to work in young adults with stroke

Category	Measure	Statistical analyses	Outcomes
Neurological factors			
Severity of stroke	National Institutes of Health Stroke Scale (NIHSS)	Regression model	More severe stroke at the time of admission: increased risk of being unemployed (7).
Cognitive function	Barrow Neurological Institute Screen (BNIS), Star Cancellation test with a time limit of 30 s (STAR test at 30 s), Stroke Impact Scale (SIS) – two domains	Regression model	Ischaemic stroke (IS) patients with faster processing speed, low levels of self-rated problems with memory/thinking and communication: an increase of the odds for full-/part-time work (31).
	Self-reported memory problems	Regression model	Patients with IS indicating no self-rated problems with memory: a factor for full-time employment (34).
Aphasia	NIHSS	Regression model	IS patients with moderate to severe aphasia as compared with patients with no aphasia: significantly higher rates of non-return to work (NRTW) at 1 year after IS (2).
Limb paresis	NIHSS	Regression model	Patients with mild or moderate to severe limb paresis due to IS as compared with patients without limb paresis: significantly higher rates of NRTW at 1 year after IS (2).
Visual field deficit	NIHSS	Regression model	Patients with moderate to severe visual field deficit due to IS as compared with patients with no visual field deficit: significantly higher rates of NRTW at 1 year after IS (2).
Cardiovascular factors			
Type 1 diabetes	Trial of Org 10172 in Acute Stroke Treatment (TOAST)	Regression model	IS patients with type 1 diabetes mellitus: higher rates of NRTW (2).
Large anterior stroke	TOAST	Regression model	IS patients with a large anterior stroke as compared with those with small strokes: significantly higher rates of NRTW at 1 year after IS (2).
Small vessel occlusion	TOAST	Regression model	IS patients with small vessel occlusion: higher rates of NRTW (2).
Large artery disease, hypertension, recurrent stroke, and carotid artery disease (CAD)	TOAST	Regression model	Four significant factors: predictive of severe disability and inability for patients with IS (30).
Functional outcomes, physical ability	Modified Rankin Scale (mRS)	Regression model	IS patients with mRS 0–1 (excellent outcome): a factor for full-time employment (34).
	Stroke Impact Scale (SIS)	Group comparison	Levels of self-rated physical ability in IS patients: significant differences between groups (no work and full-/part-time work) (31).
	Activities of daily living (ADLs)	Chi-squared test	Stroke patients dependent in ADLs (4.1% vs 77.8%): less likely to resume work ($p < 0.001$) (33).
		Spearman's correlation test	Stroke patients independent in ADLs: positively correlated with return to work (RTW) ($p \leq 0.001$) (32).

Many factors have been studied that predict RTW in young stroke survivors. Due to the large number of variables established, predicting factors can be grouped into neurological, cardiovascular, and physical impairment-related factors; psychosocial factors; demographic and job-related factors. Neurological determinants are the main factors that affect RTW (5, 35). Although the RTW process is very individual and influenced by multiple factors, stroke severity is the most robust factor (14, 17). The second most influential factor affecting RTW is cognitive ability. Although cognitive rehabilitation programmes after IS are available, it is a frequently undervalued area of care for young patients (7). A previous systematic review of RTW after young stroke highlighted the importance of assessing cognition in working age and young stroke survivors (7). Another significant predictor of RTW is independence in activities of daily living

(ADLs). Stroke patients dependent in ADL were less likely to RTW (33). Furthermore, higher rates of NRTW one year after IS were observed in patients with moderate to severe aphasia and limb paresis due to IS (2). Similarly, the most common predictors of RTW identified in a previous systematic review were greater independence in ADLs, fewer neurological deficits, and better cognitive ability (7).

The higher prevalence of RTW also significantly affects psychosocial factors such as depression and fatigue (31), perception of importance of work, higher socioeconomic status, social support, perception of being a burden (11), or social aspects such as anxieties and reactions (28). A prediction model for quality of life in patients one year after stroke showed that, in addition to other factors, anxiety had a direct effect and social support had an indirect effect on their quality of life (39).

Table 3. Psychosocial factors associated with return to work in young adults with stroke

Category	Measure	Statistical analyses	Outcomes
Psychosocial factors			
Depression and fatigue	Hospital Anxiety and Depression Scale (HADS) – anxiety and depression, Short Form 36 (SF-36) – energy/fatigue subscale	Group comparison	Self-rated depressed mood and fatigue in ischaemic stroke (IS) patients: significant differences between groups (no work and full-/part-time work) (31).
Fatigue	A narrative analysis of e-mail conversations	Thematic analysis	Fatigue and impact of both work and non-work time: an important area for future studies (28).
Positive attitudes towards return to work (RTW)	Self-reported measure	Regression model	Stroke patients' perceived importance of work: positively rated RTW (13).
Socioeconomic status	Self-reported measure	Regression model	Higher socioeconomic status of stroke patients: higher prevalence of RTW (13).
Social support	Self-reported measure	Regression model	Higher external support of stroke patients from others for RTW: higher prevalence of RTW (13).
Perception of being a burden to others	Self-reported measure	Regression model	Stroke patients' perception of being a burden to others: associated with RTW (13).
Social aspect/being exhausted	A narrative analysis of e-mail conversations	Thematic analysis	Social aspect (anxieties and reactions): described with each work-related situation. Exhaustion: referred to as a consequence of altered mental processing and fatigue (28).
Mood/pain	Longitudinal Integration Database for Health Insurance and Labour Market Studies in Sweden (LISA)	Chi-squared test	Stroke patients experiencing low mood (54.0% vs. 78.2%) or pain (52.5% vs. 78.6%): less likely to resume work ($p < 0.001$) (33).

Table 4. Demographic and job-related factors associated with return to work in young adults with stroke

Category	Measure	Statistical analyses	Outcomes
Job characteristics			
Occupational status	Helsinki Young Stroke Registry	Regression model	Lower-white-collar workers at 5 years after ischaemic stroke (IS): higher rates of NRTW. Patients at 1 year after IS who were blue-collar workers or other or unknown workers (entrepreneurs, students, pensioners, or unemployed) compared with upper-white-collar workers: significantly higher rates of non-return to work (NRTW) at 1 year after IS. White-collar workers had significantly higher rates of return to work (RTW) (81% of upper-white-collar, 73% of lower-white-collar) than blue-collar workers (55%) (2).
Income	Longitudinal Integration Database for Health Insurance and Labour Market Studies in Sweden (LISA)	Regression model	Stroke patients with low income: less likely to RTW (69.9% in a low-income group compared to 79.9% in a high-income group, $p < 0.001$). High income: associated with increased chance of RTW compared with low-income patients (33).
Demographic variables and other aspects			
Educational level	International Classification of Functioning, Disability and Health (ICF)	Spearman's correlation test	Stroke patients with secondary school education or less: 5 times more likely to NRTW as compared to their tertiary educated counterparts ($p = 0.005$) (32).
Age	Sahlgrenska Academy Study on Ischaemic Stroke (SAHLSIS)	Group comparison	IS patients with lower age: association with full-/part-time work (31).
	LISA	t-test	Stroke patients in the youngest group (25–34 years): less frequent RTW (63.1%) compared with 75.9% in 35- to 44-year-old and 74.3% in 45- to 55-year-old patients (33).
Gender	SAHLSIS	Group comparison	Higher frequency of men with IS stroke: associated with full-time work (31).
	Self-reported questionnaire	Regression model	Male IS patients: a factor for full-time employment (34).
	Helsinki Young Stroke Registry	Regression model	Male IS patients: higher rates of NRTW at 1 year after IS (2).
Country of birth	LISA	Chi-squared test	Stroke patients born in Sweden (75.5%) or other Nordic countries (74.3%) compared to other European countries (61.7%) or countries outside Europe (57.3%) ($p < 0.001$): higher proportion of RTW (33).
Time of follow-up (FUP)	FUP interval	Regression model	Longer duration of FUP in stroke patients: increased risk of being unemployed (7).

Other non-significant predictors were reported in the selected studies. Baseline skill level (5), retaining the ability to run a short distance (11), and higher independence in ADL (11) were not associated with RTW. However, other studies provide strong evidence that independence in ADLs is positively associated with RTW (18). No significant differences were found in type of work (skill levels) and in levels of self-rated leisure-time physical activity between no work and full- or part-time work groups (31). These factors may also influence RTW after IS.

As stroke is the main cause of disability, it is necessary to support young stroke survivors to RTW, as it provides psychosocial comfort and facilitates independent living (18). In terms of the type of supportive interventions, only two studies have been found. As is obvious, these studies cannot provide a complete summary of possible useful interventions.

Although several types of interventions are reported in the literature in adults up to 65 years, authors of reviews have agreed that there is a scarcity of studies on the issue (7, 15, 21).

Beneficial interventions such as workplace interventions aimed at patient functional ability and professional challenges, resource facilitation, and dedicated occupational services have been reported in a systematic review (21).

Individually tailored vocational rehabilitation is the most frequently reported positive factor in the English language literature (40). Younger stroke survivors may also benefit from a long-term community care plan and long-term rehabilitation (27). Interventions tailored to improve neurologic deficits can accelerate RTW in young adults. Furthermore, interventions may be supportive of improving quality of life and satisfaction with life (7).

Our review questions remained only partially answered. In line with previous studies, this scoping review confirms that RTW is a multifactorial problem influenced by a large number of factors and that there is insufficient evidence concerning RTW interventions. Future studies should focus on examining effective interventions to help young stroke survivors RTW. There is also a lack of studies describing the experience of RTW of young adults that could contribute to a deeper understanding of the problem.

The search was limited to the electronic scientific databases accessible to the authors' institution. The comparative analysis of included studies was limited, mainly due to the different study designs across studies and inherent heterogeneity in the subtypes of stroke. RTW was evaluated at various times of follow-up and a varying number of variables were used in the included studies. These factors could contribute to inconclusive findings. Finally, one important limitation is that one of the studies included stroke patients as young as 15 years; as this was only a small number of respondents, we strongly believe that it could not influence the results of RTW estimation in young adults. In the context of the findings regarding the review, it is necessary to consider the individual factors of patients with IS when implementing them into practice.

CONCLUSION

The rate of RTW in included studies varied. The frequency of RTW in young stroke patients, independent of the time of assessment, ranged from 42.4% to 86%. The unemployment rates ranged

from 21% after seven years to 46.9% after five years of follow-up. RTW after young ischaemic stroke is a complex process and multidimensional problem which is affected by clinical variables (level of neurological deficits, cognitive ability, independence in ADLs, fatigue and depression, cardiovascular factors), as well as the socioeconomic and occupational status. There is insufficient evidence concerning RTW interventions. Future studies should focus on examining effective interventions to help young stroke survivors RTW. There is also a lack of studies describing the experience of RTW of young adults that could contribute to a deeper understanding of the problem.

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Conflicts of Interest

None declared

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